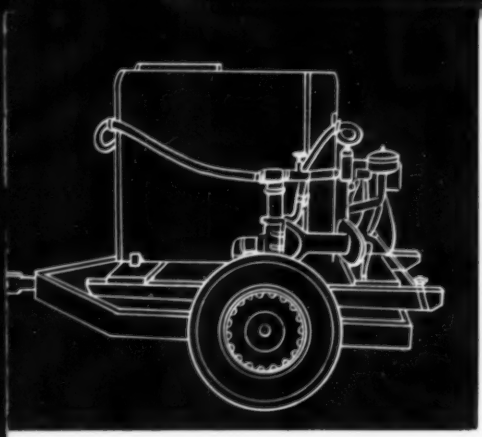

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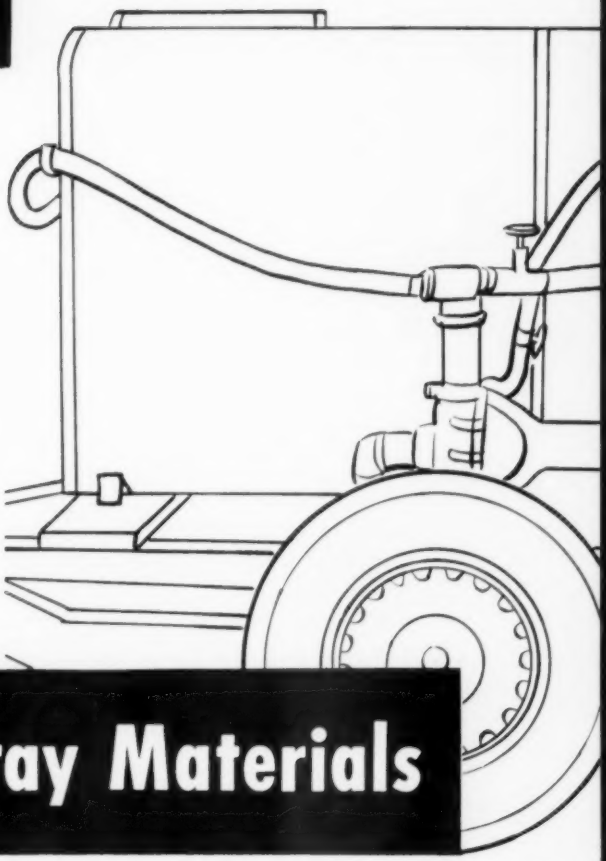

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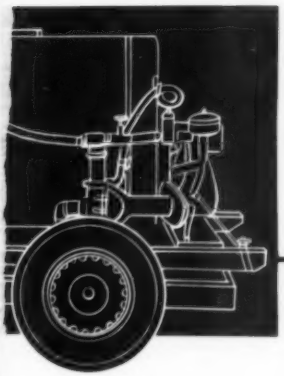

A PRE-MIXER FOR ORCHARD SPRAY MATERIALS

C. W. Terry, R. E. Adams, and K. G. Parker

The preparation of spray mixtures often presents some difficulty and is time consuming. Many of the materials used are insoluble in water and some are difficult to suspend. Certain materials handled in the solid form must be dissolved in the sprayer tank, sometimes in the presence of other materials that increase the difficulty of preparing a complete solution.

With the advent of the mist concentrate method of spraying, these difficulties are multiplied; and with certain materials, uniform mixtures of the heavy suspensions required by this method cannot easily be prepared in the sprayer tank. At best, the toxicant must be added to the sprayer tank very slowly, which requires considerable time that could otherwise be spent in the spraying operation.

It was suggested that a pre-mixer should serve a useful purpose. The machine should have a low-pressure pump with sufficient capacity, when necessary, to pump the entire contents of the tank through it in a few minutes. An agitator is needed to maintain the suspension once the materials have been suspended by passage through the pump.

Figure 1. Rear view of pre-mixer, showing most of the essential features. The clutch on the agitator shaft does not show clearly in the photograph.

Description of Machine

The experimental machine (figure 1) is described here, and modifications for use are suggested on pages 7 and 8.

The basic parts are:

A two-wheel trailer with a channel iron bed

A 200-gallon sprayer tank with agitator

A centrifugal pump, with 200 gallons per minute capacity at 20 pounds pressure, fitted with a 2-inch suction and a 2-inch discharge pipe fitting

A 6-horsepower 1-cylinder air-cooled engine.

The weight on the trailer is somewhat more than a ton when the tank is fully loaded. Not all of this weight, however, is carried on the trailer wheels. The various units on the trailer (figure 2) are mounted to make a light load on the drawbar when the tank is empty; but with a full tank a fair proportion of the weight is carried on the tractor, or truck, which tows the pre-mixer.

Approximate weights of the parts used, and the load carried, are as follows:

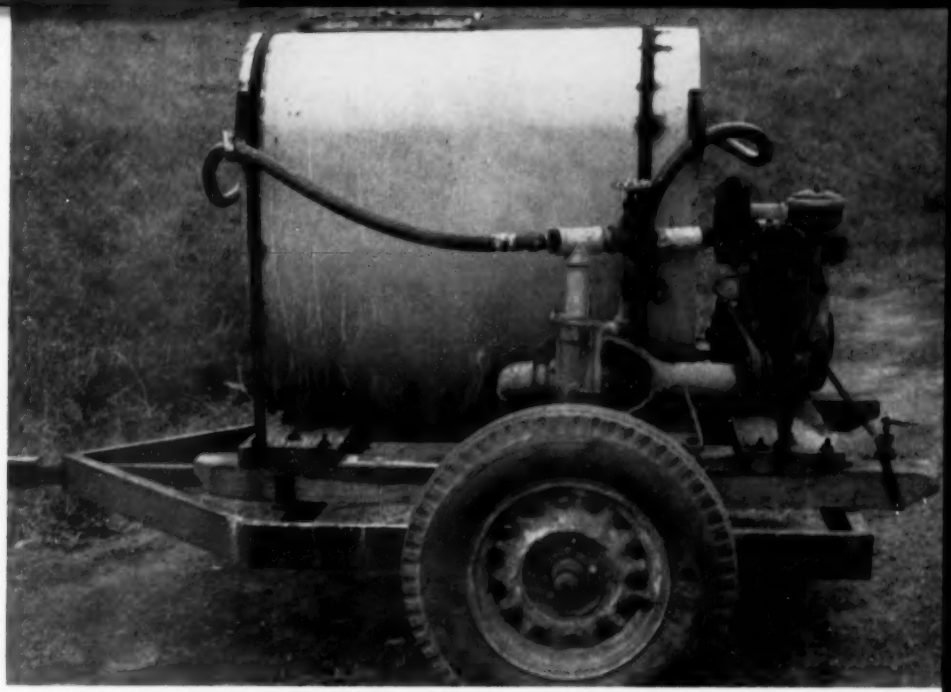

Figure 2. Side view of the pre-mixer, showing engine, pump, discharge pipe fittings, and small hose.

Parts	*Pounds*
Tank	200
Pump	125
Engine	175
Piping and hose	50
Miscellaneous parts	50
Water and spray materials	1700

Clutches are used on both the agitator drive and the pump to permit easy starting of the engine and to allow running either without the other. The agitator is geared to operate at about 500 revolutions per minute, nearly double the usual rate.

The pump connections are shown in figure 3. The pump inlet is connected to a fitting in the bottom of the tank so that it draws off the materials that settle there and that are not picked up by the agitator paddles. Another 2-inch pipe with a gate valve is connected to this lower tank fitting to facilitate draining. The pump discharges through a short 2-inch nipple into a tee. One side of the tee is bushed down to 1-inch pipe size, and a hose is attached that can be used to discharge the spray mixture back into the tank for continuous circulation to assist in mixing. The rate of circulation can be regulated by varying the

Figure 3. Pump and connections. The clutch, shown in figure 1, was added after this picture was taken.

pump speed but normally is approximately 75 gallons per minute. The other side of the tee is coupled to a 2-inch valve and larger hose through which the spray mixture can be pumped into the tank of the sprayer.

A cut-off valve is attached at the free end of the smaller line (figure 1) for the convenience of the operator while mixing. There is a similar cut-off valve on the larger line for use when pumping over the prepared mixture into the sprayer tank.

A screen may be used in the top of the pre-mixer tank, but in the experience of the writers this screen is a hindrance and is not needed.

Use of Machine

How to use this machine in the preparation of a spray mixture varies and is simple. The best method for one mixture may not be the best for another, but with a little experience the grower can quickly learn how best to prepare the mixtures he uses. Some general suggestions are offered as a guide.

The simplest method is to fill the tank with the desired amount of water, start the pump and agitator, then dump the spray materials all at once into the top of the tank. Ordinarily, any adjuvants, such as spreaders and stickers, would be added first. The valve at the attached end of the large line is closed during this operation, and the water is circulated back into the tank through the small line. With most materials, mixing is almost immediate, and the mixture is ready to be pumped over through the larger line into the sprayer tank.

With materials difficult to make wet and which tend to float in lumps on the surface of the water, either of two methods may be used.

The first, and perhaps the easiest, is to proceed as above and to direct the stream of water by hand from the return onto the floating clumps of material. The material is forcibly wetted and driven into suspension.

The second method takes more advantage of the recirculation feature of the machine. With the tank only partly filled with water, and with the agitator and recirculation system operating, the spray material is added and allowed to mix before adding the remainder of the water. With this method, the lumps are wetted when they are forced through the pump.

The writers have not prepared oil emulsions with this machine, but, based on general experience with other equipment, the pre-mixer should be satisfactory for that purpose. The procedure would be that usually followed for preparing emulsions, using the hose for returning the spray into the tank during the emulsifying process.

For materials very easy to mix, it may be neither necessary nor desirable to circulate the mixture through the pump, depending entirely on the agitator for the mixing operation.

With the mixture completed, the recirculation is stopped; and the agitator is kept running to maintain a uniform suspension. The mixture is

pumped over into the sprayer tank through the larger hose. The agitator of the sprayer should be running during this operation.

Special Considerations and Suggested Modifications

With materials difficult to mix, it may be necessary to wait a few minutes before pumping the spray mixture into the sprayer tank. It may be advantageous to prepare a fresh mixture in the pre-mixer as soon as a tankful has been pumped over and to leave the pre-mixer running while the first tankful is being sprayed out. Then the fresh mixture is ready as soon as it is needed. This method was found useful, for example, for copper materials and for paste sulfur. With certain materials, such as the micronized sulfur used in the experiments, apparently there was enough wetting agent in the mixture to cause excessive foaming because of the extended violent agitation. Perhaps this could be prevented by reducing the agitation, but it may not be practical to use this extended mixing procedure for all materials.

For certain purposes, it may be desirable to operate the agitator at speeds lower than the 500 revolutions per minute indicated. Also, on occasion it may be necessary to reduce the rate of delivery through the pump. The easiest way to accomplish this result is to reduce the speed of the motor by throttle or governor control. With materials that tend to foam excessively, reducing the rate of operation of the agitator should minimize this problem. If the larger hose is used for returning the spray mixture into the tank, a reduced speed of operation of the pump would be desirable to reduce the load on the engine. It would be feasible, however, to reduce the rate of circulation through the pump without reducing engine speed by partly closing the valve at the end of the hose. This procedure, likewise, would reduce the load on the engine. It could be used when it is desired to reduce the rate of recirculation while maintaining full agitation.

Except for the greater difficulty of handling the larger hose, the smaller one is not needed at all. The larger one can be used for recirculating the spray mixture. In that event, it would be well either to reduce the engine speed or to close the valve partly at the end of the hose. This should be done particularly if the pre-mixer is to be left running while a tankful is being sprayed out. For that purpose the engine could be left running at essentially an idling speed.

The hose or hoses used need not be heavy walled. The pressure developed by the pump is low, and lightweight hose withstands the pressure and is preferred because of the greater ease of handling. Some way should be provided to fasten the end of the hose above the opening in the top of the pre-mixer tank so the machine can be left unattended while mixing and to make the operation easier.

This machine may be mounted on a truck and used as a nurse rig. In

tact, the chief differences from nurse rigs currently in common use are the provisions for circulating the entire spray mixture through the pump and the accelerated agitation. Many nurse rigs now in use probably could be modified easily to embody all essential features of the pre-mixer.

In the experimental rig, a 200-gallon tank was used. The grower might want a larger tank. The tank need not necessarily be the same size as that on the sprayer to be serviced. It is best to pump all of the mixture over into the sprayer tank at each operation, but part of the water may be added in the sprayer tank itself. However, if this is done, the sprayer will have to be brought to the supply tank for each load, the pre-mixer being used only for mixing and not taken away from the water supply.

Special Needs for Pre-mixing

The very heavy suspensions of paste sulfurs used in the concentrate sprays are difficult and time consuming to prepare. With the circulation of the mixture through the pump of the pre-mixer, very uniform suspensions of as much as 120 pounds of paste sulfur in 100 gallons of spray have been easily prepared.

In 1955, use was made of iron sulfate on a trial basis as a safener for the mixture of glyodin and lead arsenate. Russeting of the fruit was encountered with this mixture, particularly when used in the mist concentrate method. Apparently, the iron sulfate was not completely dissolved. With the pre-mixer there should be no such difficulty in obtaining complete solution of this material.

With certain dry fluffy powders, such as ferbam, growers frequently resort to preparing a slurry in a pail. With this machine such materials are easily mixed directly in the tank by either directing the stream of water from the hose toward the floating-material on the surface of the water or by preparing the mixture with the tank only partly full of water and depending on passage through the pump to make it wet. In fact, by using the latter method the writers have satisfactorily mixed materials that were taken off the market partly because of extreme difficulty in mixing.

July 1956

Cooperative Extension Service, New York State College of Agriculture at Cornell University and the U. S. Department of Agriculture cooperating. In furtherance of Acts of Congress May 8, June 30, 1914. M. C. Bond, Director of Extension, Ithaca, New York.